



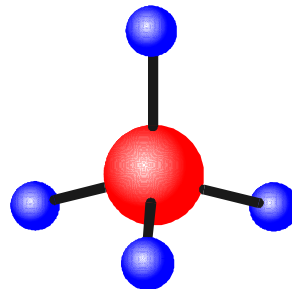
What is...

# Coal Mine Methane?

**Methane** is a tasteless, odorless, colorless, non-toxic gas. It is the primary constituent (about 98%) of natural gas.

**Coalbed Methane** is methane gas contained in coal. When this gas contains other constituents, it is sometimes referred to as coal seam gas.

**Coal Mine Methane** is methane gas that is released from coal or surrounding rock strata during the process of coal mining.

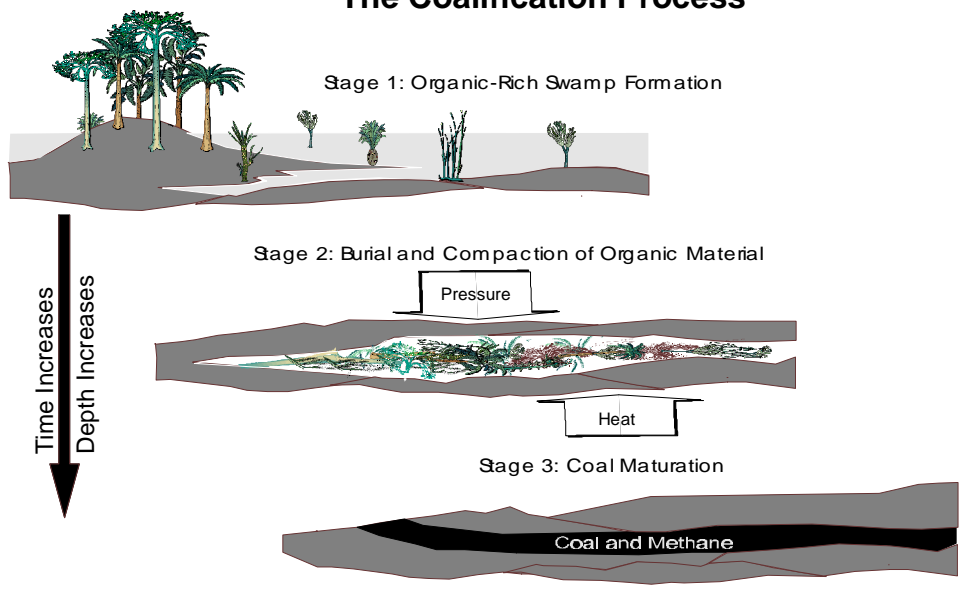


methane ( $\text{CH}_4$ ) molecule is composed of one carbon atom and four hydrogen atoms

## How is it Formed?

Coalbed methane is formed during coalification, which is the process that transforms plant material into coal. Organic matter accumulates in swamps as lush vegetation dies and decays. Gradually, streams carry sediment into the swamp, burying the organic matter. The weight of the overlying sediment begins to compact the organic matter. As the thickness of the overlying sediment increases, burial depth increases, as does temperature. This creates physical and chemical changes to the organic matter, resulting in the formation of coal and the production of methane, carbon dioxide, nitrogen and water. As heat and pressure increase, the carbon content (rank) of the coal increases. Generally, the deeper and/or higher the rank of the coal seam, the higher its methane content. Coalbeds generally do not release this methane to the atmosphere unless exposed by erosion or disturbed by mining.

### The Coalification Process



## Why is Coal Mine Methane a Problem?

- **Mine Safety.** Methane is explosive when it is mixed with air. Therefore, it is a hazard to coal mining and must be removed from gassy mines so that it does not lead to fatal explosions.
- **Global Climate Change.** After removing coal mine methane from a mine, some companies use it as fuel, but most simply emit it to the atmosphere. Because methane is a greenhouse gas, this contributes to global warming. In fact, methane significantly contributes to global warming because it is approximately 21 times more potent (as a greenhouse gas) than carbon dioxide (CO<sub>2</sub>). Using coal mine methane as fuel, rather than emitting it to the atmosphere unburned, helps slow the rate of climate change by reducing its global warming impact by approximately 20 times.

### Coal Mine Methane and Climate Change

One billion cubic feet (BCF) of methane is equal to the yearly natural gas consumption of about 8,400 U.S. households. Recovering and using just 1 BCF of coal mine methane is equal (in terms of global warming reduction) to taking nearly 90,000 cars off the road! This illustrates why every BCF of methane that mines recover and use can have a significant positive impact on the global environment.

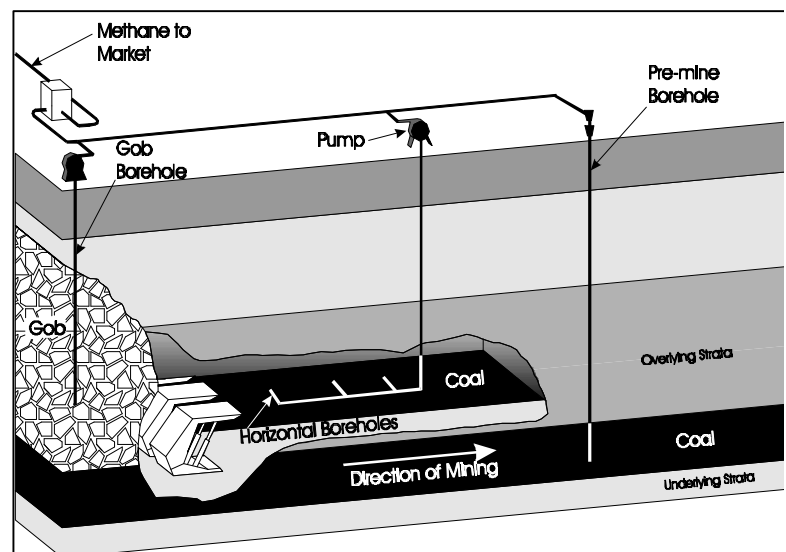
## How do Mines Handle Methane?

Mines remove methane from their working areas by using ventilation fans. These fans emit large volumes of air mixed with low concentrations (0.3-2%) of methane to the atmosphere. Particularly gassy mines must supplement their ventilation systems with methane drainage systems. These gassy mines use one or more of the following methods to drain methane:

- Pre-mine boreholes, drilled from the surface, drain coalbed methane from **unmined** areas--either in advance of mining operations, or from coal seams that will never be mined.
- Gob boreholes, drilled from the surface, drain coal mine methane from gob areas (gob is the fractured zone caused by collapse of the strata around the coal seam **after mining**).
- Horizontal boreholes, drilled inside the mine, drain methane **before mining**.

Gob wells and horizontal wells typically drain gas containing 30% to 80% methane, and gas drained from pre-mine wells often contains more than 90% methane.

**Very gassy mines must augment their ventilation systems with drainage. Some mines vent the methane they drain to the atmosphere unburned, but an increasing number of mines use the drained methane as fuel.**



Pre-mine, gob, and horizontal boreholes at an underground mine

## ***What is Coal Mine Methane Profitably Used For?***

**C**oal mine methane is used for the same purposes as conventional natural gas. Pipelines transport it to homes and businesses for use in heating and cooking, or for industrial purposes. Mines or power plants use it to produce steam or to generate electricity. United States coal mines produce more than 150 billion cubic feet (BCF) of coal mine methane each year. Of this, mines recover nearly 50 BCF for use as fuel, primarily for sale to pipeline companies.



**Coal mine methane-fueled brine water evaporator, Morcinek Mine, Poland. Photo courtesy Aquatech Services, Inc.**



**Coal mine methane-fueled generators, Appin Colliery, Australia. Photo courtesy Energy Developments Ltd.**

***In the United States and around the world, coal mines recover methane for...***



- Pipeline injection
- Local use (to meet the fuel needs of nearby industries)
- Power generation (on-site or for sale to the power grid)
- Other on-site uses (drying coal, heating water or buildings at the mine, or compressed for use in fueling mine vehicles)



## ***Is Coal Mine Methane Being Used to its Full Potential?***

**N**o, it isn't. Methane recovery and use projects are underway at many gassy mines in the United States and other countries. Many more mines, however, do not recover and use their methane, because of a variety of barriers. These obstacles include unresolved legal issues concerning ownership of coal mine methane, a lack of information about profitable opportunities, and other technical and institutional barriers. In the United States, EPA's *Coalbed Methane Outreach Program* is addressing these barriers by working with industry and other government leaders to promote the development of environmentally beneficial, economically attractive methane recovery projects at coal mines.

## For More Information

To learn more about coal mine methane opportunities, please contact:

Coalbed Methane Outreach Program  
U.S. EPA (6202J)  
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Fax: (202) 565-2077

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Internet: [www.epa.gov/coalbed](http://www.epa.gov/coalbed)

For general information, call  
1-888-STAR-YES (1-888-782-7937)



## Related Publications

EPA has published many coal mine methane reports, including:

***Identifying Opportunities for Methane Recovery at U.S. Coal Mines: Draft Profiles of Selected Gassy Underground Coal Mines* - Office of Air and Radiation, September 1997.** Provides information about specific opportunities to develop methane recovery projects at large underground coal mines in the United States.

***A Guide to Financing Coalbed Methane Projects* - Office of Air and Radiation, January 1997.** Addresses issues related to coalbed methane project finance.

***A Guide for Methane Mitigation Projects: Gas-to-Energy at Coal Mines* - Office of Air and Radiation, February 1996.** Provides guidance for developing programs to reduce methane emissions from coal mines through coal mine methane recovery and use.

***Finance Opportunities for Coal Mine Methane Projects: A Guide for West Virginia* - Office of Air and Radiation, August 1995.** Provides information regarding financial assistance opportunities available in West Virginia.

***Finance Opportunities for Coal Mine Methane Projects: A Guide for Southwestern Pennsylvania* - Office of Air and Radiation, June 1995.** Provides information regarding financial assistance opportunities available in Southwestern Pennsylvania.

***Economic Assessment of the Potential for Profitable Use of Coal Mine Methane: Case Studies of Three Hypothetical U.S. Mines* - Office of Air and Radiation, May 1995.** Provides information on the economics of methane use.

To order these reports, or to obtain a list of other coal mine methane publications, call  
1-888-STAR-YES (1-888-782-7937).